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component will be moved in the opposite direction. When the motion becomes perpendicular to the line of sight, the lines recover their true wave-length and become single.

"The relative velocity as derived from one set of measures comes out as ninety-four miles a second, and as one hundred and two miles per second from another set. If the orbit is circular, and its plane passes through the sun, the distance traveled by one component in fifty-two days, regarding the other as fixed, would be about nine hundred million miles; and the distance apart of the two components would be one hundred and forty-three million miles, or about equal to that of *Mars* from the sun. The combined mass of the two must be about forty times that of the sun, to give the required period; and if the orbit is inclined to the line of sight, the dimensions of the orbit and the corresponding masses must be greater.

"In a later postscript, written on January 11th, Professor PICKERING says that the period of ζ *Ursæ Majoris* appears to be fifty-two days, instead of one hundred and four, and that its orbit is noticeably elliptical.

"A similar phenomenon has also been observed with regard to the spectrum of β *Aurigæ*. The velocity of its components seems to be one hundred and fifty miles per second, and their period four days; their orbit nearly circular. If its plane passes through the sun, it must have a radius of eight million miles, and their joint masses must be about one-fifth of the mass of the sun."—*From Knowledge for March, 1890.*

COMET OBSERVATIONS AT MOUNT HAMILTON.

From a summary of the comet observations made all over the world, during part of 1888 and all of 1889, which is given in the *Vierteljahrsschrift der Astronomische Gesellschaft* (1890, page 70), the following is condensed:

Comet 1887 V = OLBERS' comet was observed at Mt. Hamilton by Mr. BARNARD until July 5, 1888. His last observations were three months later than those at any other Observatory.

Comet 1888 IV = FAYE'S comet was observed at the Lick Observatory four days after the last European observation (Vienna).

Comet 1888 V: The last observation was made at the Lick Observatory.

Comet 1889 I was discovered at the Lick Observatory by Mr. BARNARD, on September 2, 1888. This comet is remarkable for the long duration of its visibility. It was last observed at Mt. Hamilton on May 15, 1890, about twenty-one months after discovery. No other comet has had a longer period of visibility. The Great Comet of 1811, was visible for sixteen months and twenty days only.

Comet BROOKS, 1889, January 14 (?). This comet was discovered by BROOKS on January 14. It was never seen after that date either by its discoverer or by other observers. At Mt. Hamilton it was very carefully sought for, both by Mr. BARNARD and by Professor SWIFT, who was here on a visit.

Comet 1889 II was discovered by Mr. BARNARD 1889, March 31. The last observation at Mt. Hamilton was made on November 16, after which time severe storms set in. The last observation was made at Vienna on November 21.

Comet 1889 III was discovered by Mr. BARNARD, 1889, June 23. It moves in an elliptic orbit, with a period (according to Dr. BERBERICH) of 128.3 years. It was last observed at Mt. Hamilton, August 6.

Comet 1889 IV was discovered by Mr. DAVIDSON, in Queensland, July 19. It was photographed at the Lick Observatory by Mr. BARNARD, and its photographic brightness was determined (see *Publ.* A. S. P., vol. I, p. 34), as well as its spectrum (*loc. cit.*, p. 36). The last observation was made (November 21) at Vienna.

Comet 1889 V was discovered by BROOKS 1889, July 6. It moves in an elliptic orbit, with a period of seven years. On August 1 the comet was found to consist not only of one body, but of a family of comets moving together in space. This discovery was made by Mr. BARNARD, and has been described in *Publ.* A. S. P., vol. I, p. 72. The companion comets were observed by him until November 25. The last observation of the main comet was made at Mt. Hamilton March 20, a month later than at any other observatory. Still another interesting feature is presented by this comet in the similarity of its elements to those of LEXELL's lost comet, as pointed out by Mr. CHANDLER and described in *Publ.* A. S. P., vol. II, p. 21.

Comet 1889 VI was discovered by Professor SWIFT, at Rochester, on November 16. Its orbit is elliptic with a period of seven or eight years. The last observation was made at Mt. Hamilton on January 21, 1890.

Comet 1890 — was discovered by M. BORELLY, at Marseilles, on December 12. This is the first comet discovered in Europe since 1886.

The foregoing summary shows that the excellent atmosphere at Mt. Hamilton has made it possible for the Lick Observatory to render material services to cometary astronomy by following faint comets as long as they are visible at all, thus making greater arcs available in the calculation of their definitive orbits. E. S. H.

New Instruments for the Lick Observatory.

The Board of Directors of the BACHE Fund of the National Academy of Sciences has loaned to the Lick Observatory a spectroscope specially designed for the observation of faint objects, as the Aurora and the Zodiacal Light. It will be used here to examine the spectrum of the latter object.——The Trustees of the THOMPSON Fund of the American Association for the Advancement of Science have made a grant of money for the construction of a small spectroscope to be used in connection with the great telescope in the observation of variable stars. The thanks of the Observatory are returned for these material additions to our spectroscopic equipment.——Hon. C. F. CROCKER has authorized the construction of an equatorial stand to take the WILLARD photographic telescope bought by him for the observation of the eclipse of December, 1889. The mounting will be made by Mr. BRASHEAR, and will be provided with a driving-clock, controlled in the manner invented by Mr. KEELER. The WILLARD lens, together with a 5½-inch DALLMEYER camera (lent to us by Mr. PIERSON), will be mounted side by side, for the present, and will be employed by Mr. BARNARD in making photographs of the Milky Way.——The large periscopic eye-piece made by the GUNDLACH Optical Company has been received. Its glasses are made from the new Jena material. The field-lens is of crown, and is six inches in diameter. The rays from this pass through a triple eye-lens, three inches in aperture. The whole length of the eye-piece is ten inches, and it weighs about thirteen pounds. The field of view is over thirty minutes. The equivalent focal distance is five inches, and, therefore, its magnifying power on the great telescope (focus 694.4 inches) is about 140 diameters. It will not utilize the whole area of the objective, consequently. It gives admirable views of the larger nebulæ, the moon, etc., as the field is flat and the color-correction is excellent.——A self-registering thermometer, made by RICHARD Frères of Paris, has been purchased for trial. The instrument runs a week at one winding, and appears to be very satisfactory. Its cost is but 135 francs in Paris.——An improvement to an old instrument is often more import-